Intertidal and subtidal rocky shore sampling methods: a review. Addressing the needs of WFD and MSFD

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INTRODUCTION AND AIM

As European and international legislations are developed and applied, the necessity of comparable data grows. European legislations (Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD)) compel Member States to determine, either, the Good Ecological Status [1], or the Good Environmental Status [2]. **Rocky shores** gather habitats of great importance, like macroalgal communities, which are among the principal habitats in European seas [3].

Therefore, the **AIM** is to review sampling strategies and methods used across European countries, for the assessment of intertidal and subtidal rocky shores, in order to provide an overview of sampling methodologies used.

MATERIALS AND METHODS

A bibliographical search was done using online available databases, key words and applying Boolean modifiers. Scientific peer reviewed articles published from 1999 to 2015 were selected. The search was focused on European countries.
A data matrix was created including all relevant information concerning the sampling strategies, methodologies and sample size, as well complementary information.

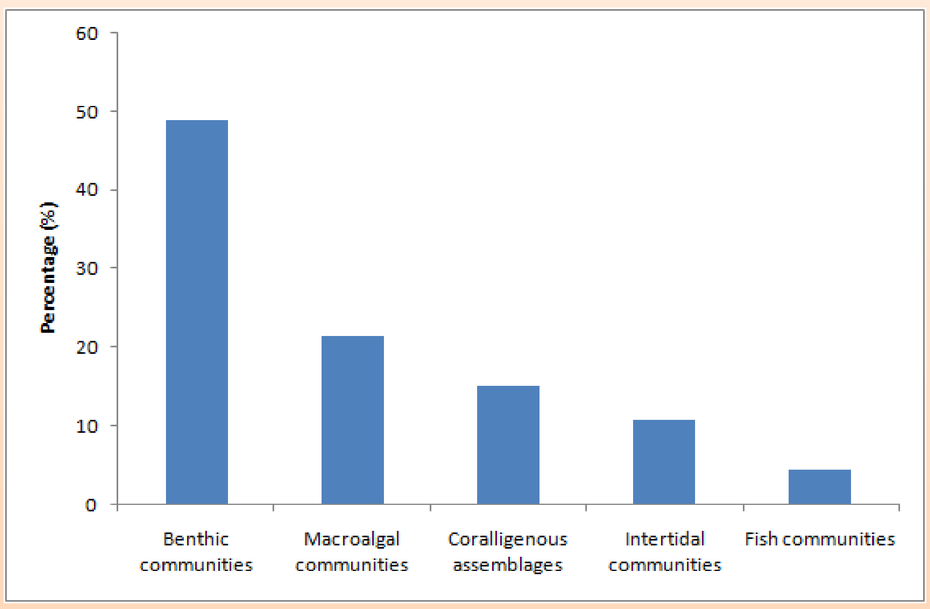

Figure 1. Percentage of biocenosis targeted to address WFD and MSFD rocky shores extracted from revised literature (n=47 published articles, from 1999 to 2015). Benthic communities include both algae and fauna.

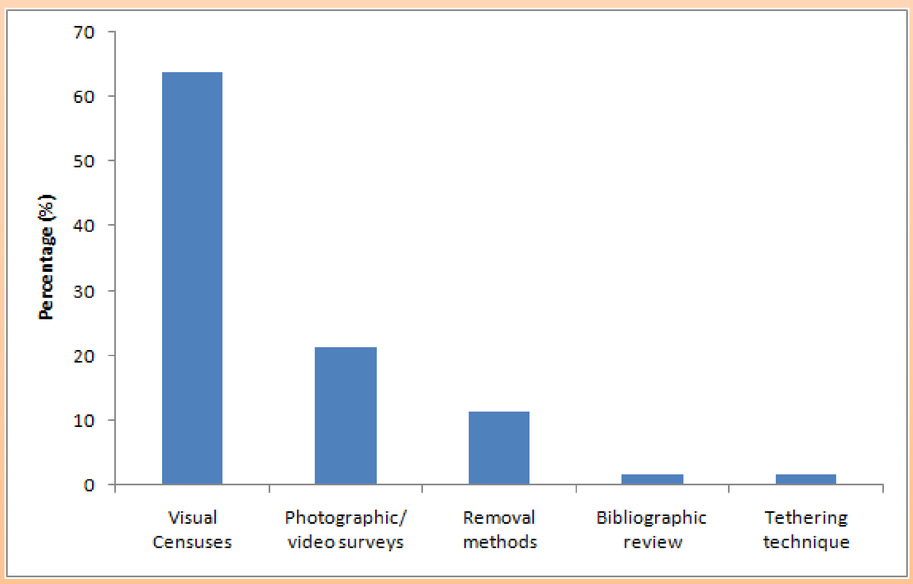

Figure 2. Percentage of sampling methods targeted to address WFD and MSFD rocky shores extracted from revised literature (n=47 published articles, from 1999 to 2015).

RESULTS AND DISCUSSION

A total of 47 research articles were selected, all related to either intertidal or subtidal rocky shores from European seas.

Biocenosis targeted by research articles are: Benthic communities (algae and fauna), Macroalgal communities, Coralligenous assemblages, Intertidal communities and Fish communities (Fig. 1). European legislations demand the use of macroalgae as water quality indicators.

Of the reviewed articles the majority are not related to any European legislation, while nearly 20% respond to WFD and only 10% concern to MSFD. Almost 13% of the studies refer to both WFD and MSFD, and 2% relate to HD (Habitat Directive). There results display the necessity of research committed to the accomplishment of European legislations.

The most applied sampling method is visual censuses (63.93%), followed by Photographic/video surveys (21.31%) (Fig. 2). Several methodologies are applied, being the most used: quadrats, applied in 45.9% of the revised articles, transects (13.11%), and areas (of variable surface) in 11.48%, depending on target species or community. Most methodologies are non-destructive (86.89%), which allows applying them in Marine Protected Areas (MPA). Sampling method size depends on sampled biocenosis and water body (Atlantic versus Mediterranean).

Taxonomic classification for the determination of organisms is done to the lowest taxonomic level possible, although the use of structural or functional groups is also present in the assessments (34.04%).

Concerning experimental designs, hierarchical sampling is applied in 36.17% of the reviewed literature, and in 63.83% of the reviewed articles, geomorphological features are used.

These preliminary results highlight the vast array of sampling methods applied in rocky bottoms, indicating the **need for standardization** of sampling techniques to gather appropriate data for addressing environmental status at European coastal areas.

References:
[1]E.C., 2000. Council Directive for legislative frame and actions for the water policy, 2000/60/EC. Off.J.E.C.(22/12/2000)
[2]E.C., 2008. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) Off,J.E.C. (25/06/2008)
[3]Mineur, F., Arenas, F., Assis, J., Davies, A. J., Engelen, A. H., Fernandes, F., Malta, E-J., Thibaut, T., Van Nguyen, T., Vaz-Pinto, F., Vranken, S., Serrão, E.A., De Clerck, O. 2014. European seaweeds under pressure: Consequences for communities and ecosystem functioning. Journal of Sea Research, 98, 91–108.

Aknowledgement:
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